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IMAGE ANALYSIS OF A SAMPLE FROM EAST KEMPTVILLE (Second Part)

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Abstract

A sample of the flotation feed (mainly table tailing) from East Kemptville was studied by image analysis[1] to determine modal analysis and liberation of the sulphide minerals. The mineral quantities (wt %) in the sample were: quartz 75.8%, mica (illite) and plagioclase (anorthite) 17.0%, apatite 3.1%, pyrite 2.2%, pyrrhotite 0.1%, chalcopyrite and sphalerite 0.4%, arsenopyrite 0.4%, cassiterite 1.0%.

Liberation analysis showed that 90% of the pyrite is in particles with at least 80% pyrite; then it can be considered that 90% of the pyrite is "free". Similarly, 86% of the arsenopyrite is "free" and 80% of the combined chalcopyrite-sphalerite is "free". The small amount of pyrrhotite is essentially locked within pyrite particles.

[1]Keywords: Image Analysis, mineral quantities, size analysis, liberation.

1 Introduction

On January 10, 1990 Mr. Marius Cristovici from MSL/LSM (CANMET) submitted a sample from East Kemptville. The sample represents the flotation feed and consists mainly of table tailing. The sample assays approximately 0.8 wt % Sn.

A report dealing with cassiterite liberation was issued on February 27, 1990 (Lastra et al. 1990). On March 14, 1990, Mr. Cristovici requested additional information on the same sample, namely to identify the presence of sulphides other than pyrite, pyrrhotite, chalcopyrite, and sphalerite and to determine the liberation of the sulphide minerals and their associations.

2 Method of Investigation

The polished section that was used for determination of cassiterite liberation was re-analyzed with the microprobe SEM-IPS image analysis system (MP-SEM-IPS).

3 Results

3.1 Mineral Quantities

The presence of the major phases and sulphides previously determined was confirmed. Arsenopyrite was more difficult to detect. After searching the entire polished section, eight small (2 to 12 μm) grains and one large (52 μm) free grain were found. Mineral quantities as reported in Table 1 were determined by image analysis in vol % and converted to wt % using appropriate specific gravities. The results are comparable with the previously reported modal analysis. It should be noted that due to the characteristics of occurrence of the arsenopyrite, its reported weight percent could be inaccurate; i.e. the solitary and large arsenopyrite grain represents 83% of the arsenopyrite measured.

Table 1: Mineral quantities in the flotation feed of East Kemptville.

Mineral	WEIGHT %
Quartz	75.8
Mica (illite) and plagioclase (anorthite)	17.0
Apatite	3.1
Pyrite	2.2
Pyrrhotite	0.1
Chalcopyrite and sphalerite	0.4
Arsenopyrite	0.4
Cassiterite	1.0
Galena	≈ 0

3.2 Liberation

Liberation of cassiterite was re-analyzed and the results were nearly identical to those previously reported.

The results for liberation of the sulphides are presented in Figures 1 to 6. Figures 1, 3, and 5 plot percent of the sulphide in the sample (PHAREA, y-axis) that is in particles with a given sulphide percent (PHPERC, x-axis). Figures 2, 4, and 6 plot percent of the sulphide (free and locked) in the sample (PHAREA, y-axis) that is in grains of a given size (PHSIZE, [μm], x-axis).

For pyrite, Figure 1 shows that $\approx$90% of the pyrite in the sample is in particles with at least 90% pyrite. Figure 2 indicates the size distribution of the pyrite grains ($\approx$80% -55 μm, K_{80}).

The small amount of pyrrhotite in the sample gives less confidence in the liberation data. An important fraction of the pyrrhotite is locked (Figure 3). The largest bar in Figure 4 represents a locked pyrrhotite grain with a grain size $\approx$17 μm. This large pyrrhotite grain is associated with pyrite.

Chalcopyrite-sphalerite exhibits (Figure 5) good liberation. Approximately 80% of the chalcopyrite-sphalerite is in particles with at least 80% chalcopyrite-sphalerite. Figure 6 discloses the size distribution of the chalcopyrite-sphalerite grains ($\approx$80% -30 μm).

For arsenopyrite, 86% of it is totally free but 83% is represented by one grain of $\approx$55 μm.

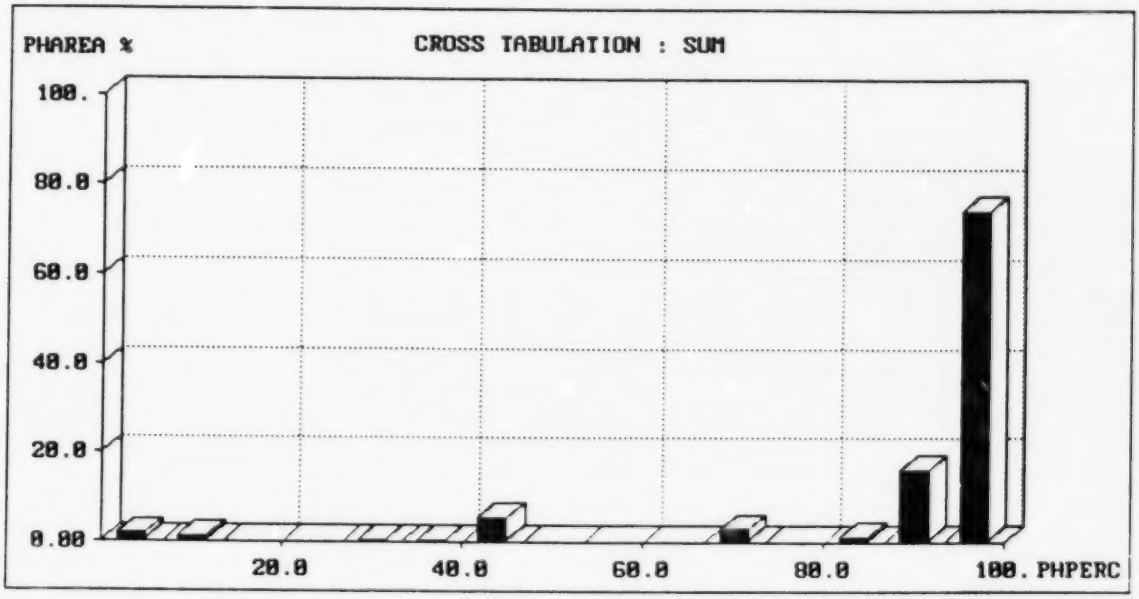

Figure 1: Volumetric percent of the pyrite in the sample (x-axis) that is in particles with a given pyrite percent (x-axis).

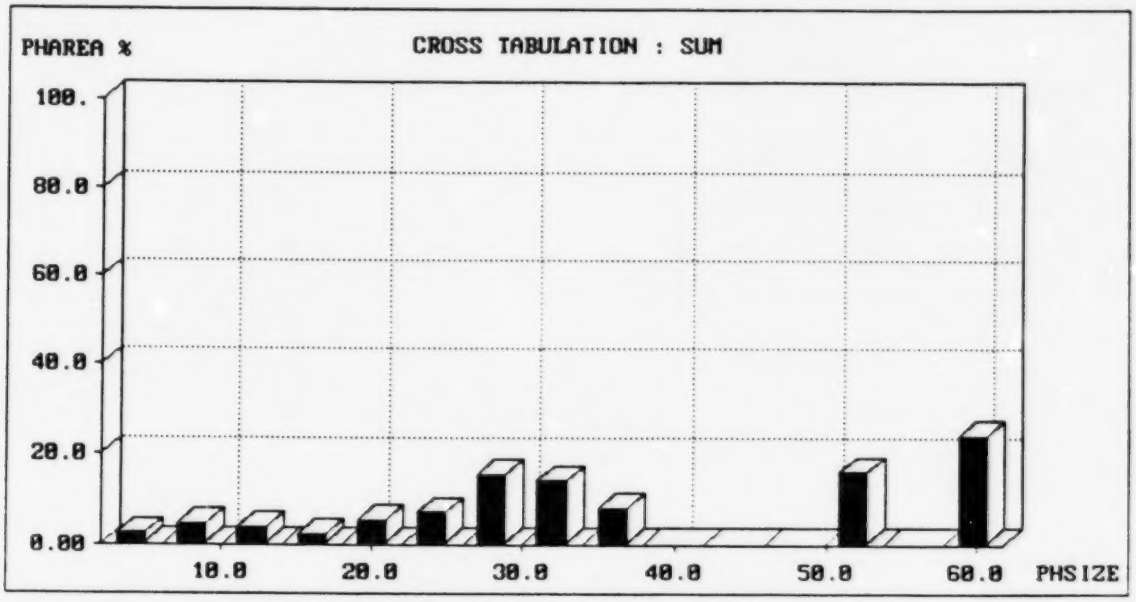

Figure 2: Size distribution of the pyrite grains. Percent of pyrite (PHAREA) present in grains of a given size (PHSIZE, μm).

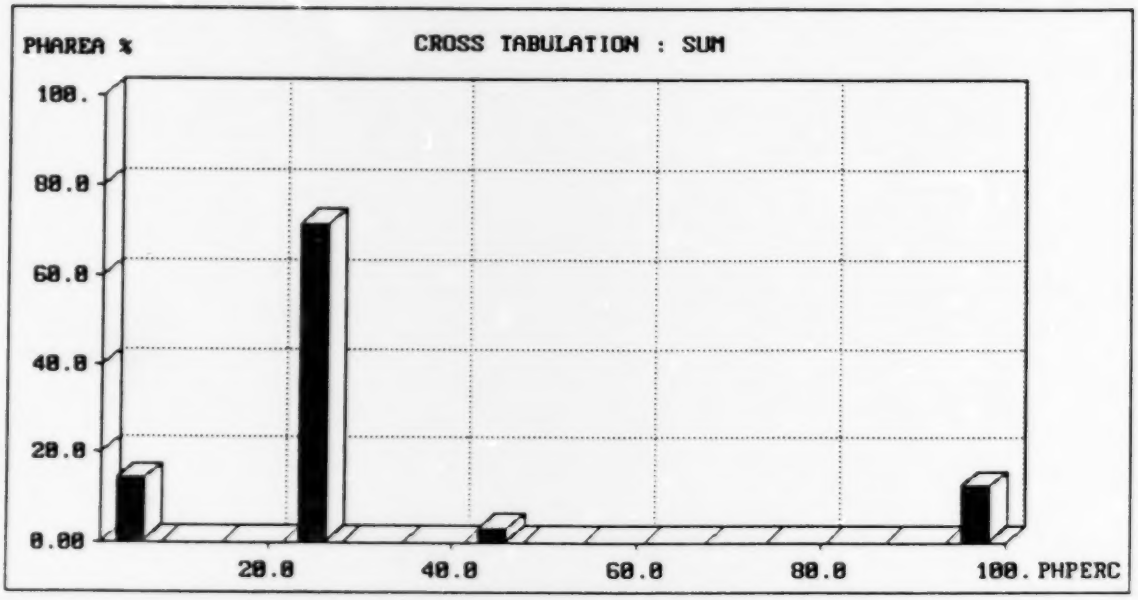

Figure 3: Volumetric percent of the pyrrhotite in the sample (x-axis) that is in particles with a given pyrrhotite percent (x-axis).

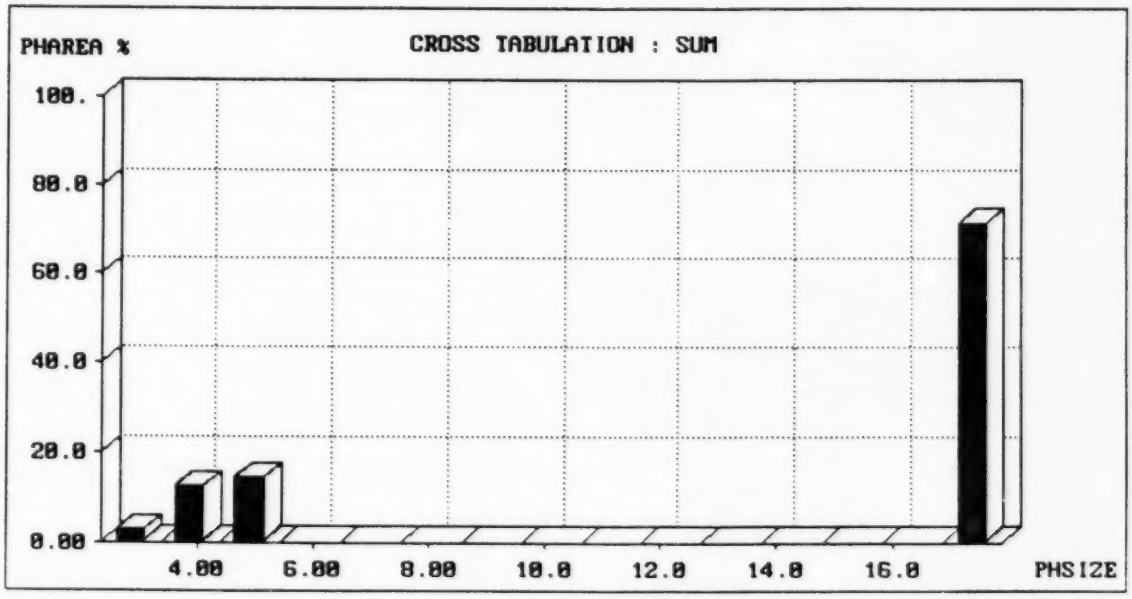

Figure 4: Size distribution of the pyrrhotite grains. Percent of pyrrhotite (PHAREA) present in grains of a given size (PHSIZE, μm).

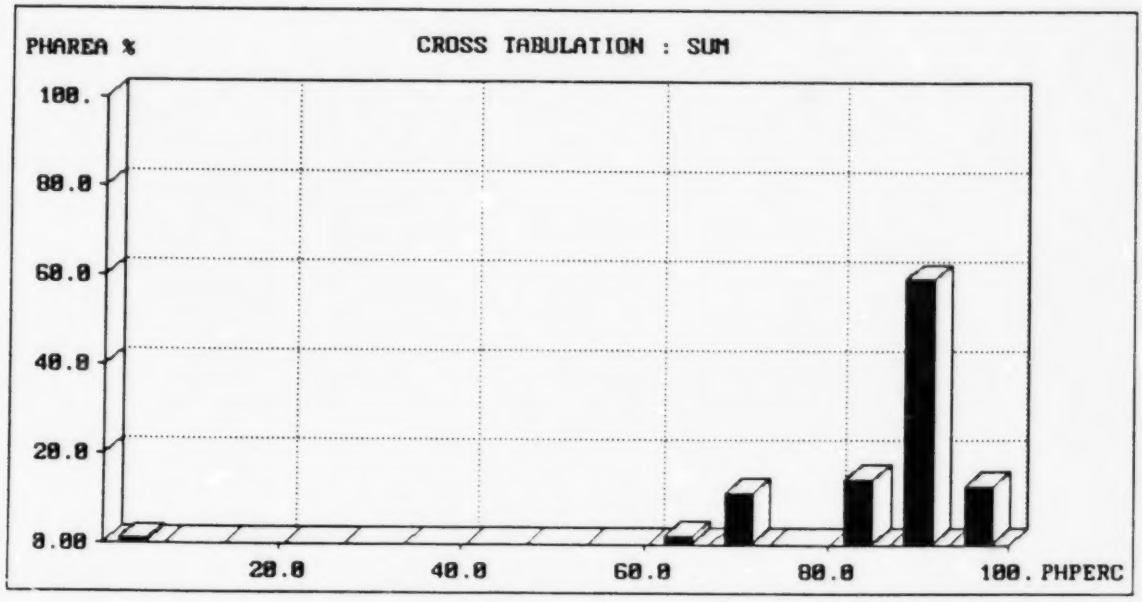

Figure 5: Volumetric percent of the chalcopyrite-sphalerite in the sample (x-axis) that is in particles with a given chalcopyrite-sphalerite percent (x-axis).

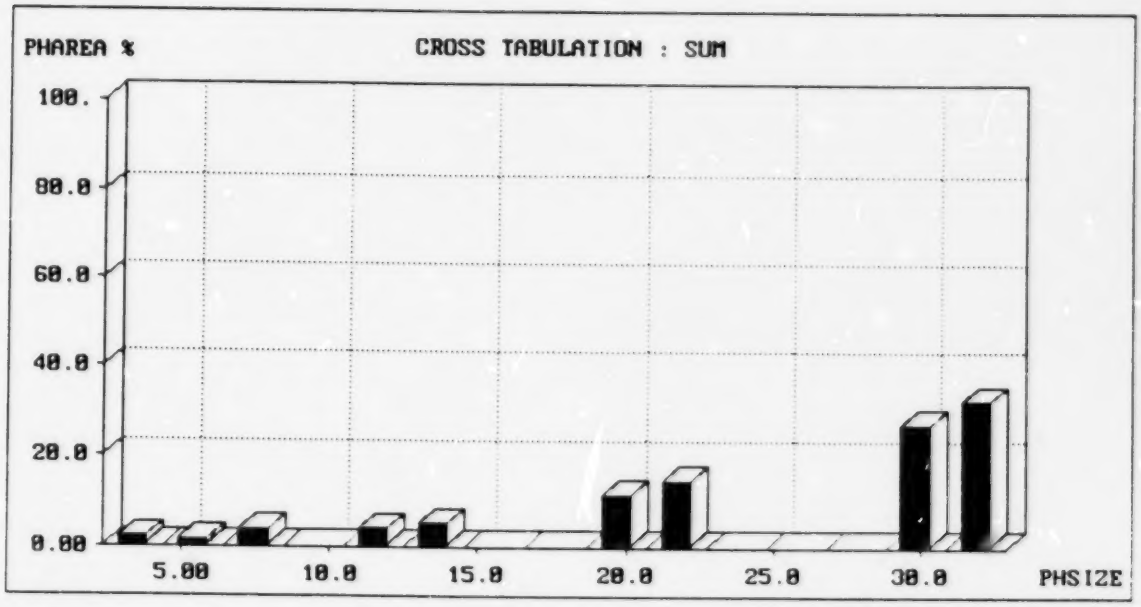

Figure 6: Size distribution of the chalcopyrite-sphalerite grains. Percent of chalcopyrite-sphalerite (PHAREA) present in grains of a given size (PHSIZE, μm).

4 Conclusions

1. The mineral quantities (wt %) in the sample are: quartz 75.8%, mica (illite) and plagioclase (anorthite) 17.0%, apatite 3.1%, pyrite 2.2%, pyrrhotite 0.1%, chalcopyrite and sphalerite 0.4%. arsenopyrite 0.4%, cassiterite 1.0%. The results are comparable with the previous reported modal analysis.
2. Liberation analysis showed that 90% of the pyrite is in particles with at least 80% pyrite; then it can be considered that 90% of the pyrite is "free". Similarly 86% of the arsenopyrite is "free" and 80% of the combined chalcopyrite-sphalerite is "free". The small amount of pyrrhotite is essentially locked within pyrite particles.
3. The size of the sulphide grains is: for pyrite and arsenopyrite $\approx$80% -55 μm, for chalcopyrite-sphalerite $\approx$80% -30 μm, and for pyrrhotite $\approx$80% -17 μm.

5 References

1. R. Lastra, R. Pinard and P. Carrière, 1990, Image Analysis of a sample from East Kemptville. Process Mineralogy, MSL, CANMET, EMR, Section Report M-4183. 5pp.